REVIEWS.

Art. XVII.—*Studien aus dem Institute für experimentelle Pathologie in Wien aus dem Jahre*, 1869. Herausgegeben von S. Stricker. Wien, 1870.

Studies at the Institute for Experimental Pathology at Vienna, for the year 1869. By S. Stricker. Part I., with four wood-cuts and two lithographic tables. pp. 110. Vienna, 1870.

The editor of this work, Dr. Stricker, is Professor of Experimental Pathology at the University of Vienna. He is the author of a late manual of histology,[1] the character and standing of which may be known from the fact that a translation of the first volume is announced by the New Sydenham Society as one of the volumes in the list of publications for the current year. He has attained to a high rank among the physiologists and microscopists of Germany, by his minute and conscientious researches, an account of many of which have been published in the proceedings of the Royal Academy of Sciences of Vienna. Among the most interesting and important of his observations are those on the minute structure of the capillaries (in which he shows that the red corpuscles often stick in the walls and thence escape—diapedesis—in contradistinction to the active wandering out of the colourless corpuscles), and also those on the development of the embryo in the eggs of the trout and batrachians.

The volume before us is a contribution to the study of the pathology of inflammation. In this subject the researches of Cohnheim, and his views as to the origin of pus-cells from the colourless corpuscles of the blood, have effected what Villemin's discovery of the inoculability of tubercle has done for the doctrine of tubercle—thrown the whole subject into a state of active fermentation, unsettled old views, given rise to new ones, and awakened a spirit of research which promises to yield us something definite and reliable upon this important subject. As an instance of the transition period in which we now are may be mentioned the fact that Mr. Simon, in the article "Inflammation," of the second edition of Holmes' *System of Surgery*, postpones all consideration of the pathology of the process, until the publication of the Appendix, because "all previous doctrines on the subject are just now in the very crisis of a consideration of which the morrow cannot be foreseen."

Although the title page bears the name of Dr. Stricker, he is the writer of but a few of the papers, the majority are from the pens of men working under his direction and supervision. His name, however, is guarantee of the reliability of the observations recorded, for, whether as author, teacher, or investigator, he stands second to none.

The following is a schedule of the contents of the volume under notice:—

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[1] Handbuch der Lehre von den Geweben des Menschen und der Thiere. Leipzig, 1868.

On the present condition of the doctrine of inflammation. Introduction. S. Stricker.

Experiments upon inflammation of the cornea. Wm. F. Norris, and S. Stricker.

Upon cell division in inflamed tissues. S. Stricker.

On the relation of vessels and nerves to the inflammatory process. S. Stricker.

On traumatic encephalitis. Dr. Frederick Jolly, Munich.

Investigations upon furrowing (Furchung) and membrane formation of the hen's egg. Dr. Jos. Oellacher, Innspruch.

On endogenous formation of pus-corpuscles in the conjunctiva of the rabbit. Dr. L. Oser.

On the inflammatory changes of mucous fibres. Dr. Janovitsch Tschainski, St. Petersburg.

On tissue changes in the inflamed liver. Dr. A. von Hüttenbrenner.

On the conduct of the fixed cells of the tail of the tadpole after mechanical irritation. E. Klein and H. Kundrat.

Inflammation and suppuration. Résumé. S. Stricker.

It will be seen therefore that the work is not a complete treatise, and does not afford us an opportunity of presenting that entire view of the subject and those definite conclusions which we hope one day to record.

Yet the evidence it bears upon its pages of the patient and laborious efforts being made to overcome the difficulties of this most intricate subject, alone, makes it well worthy of our consideration, while the positive additions it makes to our knowledge are by no means insignificant. We will try to cull something from it for the interest and benefit of our readers.

Dr. Stricker very appropriately heads his introduction with a quotation in our language from Bennett: "Inflammation is so intimately interwoven with the theory and practice of medicine . . . . that in all ages it has been made the pivot upon which the medical philosophy of the time has revolved." This quotation indicates, too, what we find to be true, that the labours and the opinions of pathologists outside of Germany have not been overlooked, and are duly estimated. He then goes on to notice the close relation which has always held between the progress of microscopical investigation and the doctrine of inflammation, and that this relation has been especially marked in regard to increasing or changing knowledge as to the genesis and growth of cells. But as we have penetrated with improved instruments deeper into the tissues, our general idea of the complex process called "inflammation" has been weakened; to an idea drawn from the bedside and the autopsy has succeeded a definition of the minutest processes of the tissue elements. Of late there has been given to one of these minute processes an undue prominence, and it is taught that the essence of the process consists alone in the passage from the vessels of the colourless corpuscles of the blood.

> "The new current of opinion has brought us only a doctrine of suppuration, and forced upon us the following alternative: We must either return to the old views, allowing the inflammatory process to have terminated with the action of the vessels, and cease to talk any more of an inflammation of non-vascular tissues, or we must not do this, but place the clinical idea—according to which suppuration is a consequence of inflammation—upside down, and derive inflammation from suppuration."

This leads him into some historical disquisition, not, however, of the subject in general, but in relation to some questions which are yet agitated and which must be taken into consideration whenever new investigations are undertaken.

The first point of interest which presents itself is another discoverer of the origin of the pus-corpuscle from the colourless blood-corpuscle. We say "another," because we so lately presented the fact that Waldenburg, in his history of the doctrine of tubercle, showed that Addison[1] long ago taught this origin. Now it is Waller[2] who, in 1846, published his observations and experiments upon the tongue of the frog, the illustrations of which are "so true to nature that we cannot doubt the accuracy of the observations." In a note, Dr. Stricker quotes the following paragraph from Waller, which we copy, together with his comment upon it, because this is a point of prime importance at the present time, and one upon which there exists wide difference of opinion.

> "In some instances the manner in which the corpuscle escaped from the interior of the tube could be distinctly followed, that part of the tube in contact with the external side of the corpuscle gradually disappeared, and at nearly the same time might be seen the formation of a distinct line of demarcation between the inner segment of the corpuscle and the fluid part of the blood in contact with it.

After admitting that to Waller must be granted priority of discovery, he says:—

> "But with a due estimate of the difficulty of a definite decision as to the perforation of the walls of vessels, I must maintain that neither Waller's illustrations nor his statements were such as to awaken confidence. I have only been able to diagnosticate a diapedesis, after I had been able, in the animal under the influence of woorara, to observe at leisure the clearly defined neck of such a corpuscle fast in the vessel-wall. So long as that has not been done it can always be objected that there may be two corpuscles, of which one adheres to the outside and the other to the inside of the wall. But such a neck Waller has neither described nor sketched. Neither can I find from his statement that he has really followed the entire act of perforation, although the passage quoted refers directly to it."

Waller therefore opposed the current doctrine of his day as to the origin of pus-cells in the blastema, but without avail, and his discovery attracted no attention. The labours of Goodsir and Redfern, however, soon effected what Waller could not, and Virchow's views have since been promulgated and arisen to the ascendant, until the year 1867, when Cohnheim again brought forward the doctrine of a derivation of the pus-cells directly from the blood, maintained this to be the characteristic feature of the inflammatory process, and by his advocacy won for it a general acceptance.

The history of experimental study of the injuries of the cornea is then sketched. To Bowman especially is given the credit of first laying stress upon the "disturbances of nutrition" following lesions of this membrane, the changes in the bloodvessels having alone been observed before. The doctrine of the origin of pus-corpuscles from the corneal cells was not changed even by Recklinghausen, who added, however, the discovery of the contractility and locomotor power of the pus-corpuscles. Soon after Cohnheim published his observations of the study of the inflammatory process in this membrane, together with his use of the chloride of gold as a means of rendering the elementary tissue forms visible. His statement, that the corneal cells do not participate in the formation of pus, but that the pus-corpuscle is here, as elsewhere, derived directly from the blood, unsettled everything. Hoffman, a pupil of Recklinghausen, has entered the lists in favour of the former views, and has been replied to by Cohnheim, who denies most positively all participation of the corneal cell in the formation of pus, and thus matters stand at present.

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[1] See this Journal for January, p. 139.

[2] The reference is to the "Philosophical Magazine," vol. xxix. pp. 271, 398.

In addition to, and entirely independent of, any questions as to the origin of pus, consideration must be taken of those processes which are a part of inflammation—the saturation of the parts with fluid exudation, and the disturbances of nutrition of the tissues.

Frankly stating that he has not gone deeply into the history of these points, the author refers to Bennett and Rokitansky as the chief advocates of the importance of the exudation. He quotes both; the former says: "It is only when the exudation has taken place that we can state positively our conviction of the presence of inflammation;" the latter, "with the exudation the inflammatory process must be looked upon as complete."

But the cell formations of such exudations were gradually thrown into the background, and the whole doctrine of exudation suffered the same fate, in bringing about which the discovery of the characteristic processes of inflammation in non-vascular tissues contributed not a little. Although the value of the process of exudation has never been entirely forgotten, we have gradually accustomed ourselves not to take the co-operation of the vessels into consideration when treating of inflammation.

> "By the labours of Cohnheim, however, attention is again directed to the circulation, and indeed to such an extent that the disturbances of nutrition are once more placed in the background. In the place of fluid exudations, formed and living elements are introduced, but it is again a material originating from the blood, whose appearance is designated as the essential characteristic of the commencing inflammation."

One other point remains—the importance of the connective tissue[1] in the inflammatory process. This tissue, according to Virchow, is the source of all the new formations of inflammation. "From the stand-point of the theorists of inflammation the organism is only a structure of connective tissue into which nerves, muscles, and glands, entirely unessential to the new formations, are shoved." From time to time, however, advances have been made, showing this doctrine to be untenable. First came the discovery of Remak and Buhl that the epithelium is also in part a source of the neoplasm, and the probability that the gland cells participated was established. It is stated that Virchow himself, by his discovery that in inflammation the nuclei of the muscles increase in number, rendered important aid. Finally the author and Leidesdorf proved that the walls of capillary vessels grow and take part in the process, leaving but a single class of cells, the nerve cells, of which no account has been taken in inflammation.

> "The recognition of the participation of gland cells, muscle nucleoli, and capillary vessels in the process of inflammatory formations has, in the meantime, scarcely diminished the great importance of the connective tissue. It is only a participation of these tissues which is vindicated in a process principally carried out by the corpuscles of the latter. Cohnheim alone speaks against this, and we can see, in his theory, a counterpart to the former doctrine of Virchow. Virchow attributed all to the corpuscles of the connective tissue; Cohnheim to the colourless corpuscles of the blood."

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[1] "Every tissue is called connective tissue whose basis substance yields gelatine when boiled."—*Cellular Pathology*, translation by Chance, p. 47.

In view of all these differences of opinion, and of the amount of this profoundly intricate subject which is not yet known, the necessity for such "studies" as are here presented is apparent, and we assent to the necessity for that sober and temperate judgment upon these matters which, the author says, is beginning to prevail, as well as recognize how true it is that these "processes do not permit themselves to be constructed by the imagination." How some of them take place in reality is attempted to be shown in the various papers of the volume, and we do not know that we can do better for the benefit of our readers than to take some one of these papers and make a pretty thorough analysis of it as the best means both of giving an idea of the manner in which the investigations are carried on, and of furnishing a specimen of the results attained.

We select for this purpose the second paper, on cell-division in inflamed tissues, by Dr. Stricker. He remarks that the usual mode of investigating inflamed tissues under the microscope, by removing them entirely from the organism, is not likely to furnish proof of the vital changes taking place in cells, and he therefore rejects this mode entirely. Cohnheim's plan of studying the process in the parts yet in connection with the living being is far preferable, yet this author has limited his observations to certain occurrences in the finer vessels and in the colourless blood-corpuscles, and to the dogma that these occurrences comprise the essence of inflammation, Dr. Stricker has never given in his adhesion.

He chose for study the tongue of the frog rather than the mesentery, as a good field for observation of the corpuscles of the connective tissue, and chiefly, it would seem, because Cohnheim had failed to observe here any changes of form in these bodies. He learned from this to prepare himself for watching. We now give his own description of events :—

"Scarcely had I entered upon this study before my attention was fixed by peculiar occurrences in the nomadic cells. I directed my observations at first in the neighbourhood of small veins, in order to be able to follow at the same time the emigration of colourless blood-corpuscles, and then soon observed that single corpuscles after their emigration, and others, whose origin I had not observed, appeared to lie quite close to the vessels. Upon closer observation I perceived that on their surface dark lines, sometimes more, sometimes less clearly defined, made their appearance, then vanished and appeared again. Sometimes a corpuscle was bridged over by one line, sometimes by two, crossing at different angles. At the crossing point appeared a deep shadow representing a cavity. The lines shifted towards one or the other pole, and changed in direction and intensity."

Remembering what he had learned from the study of furrowing in the ova of the trout, and of the batrachiæ, he was convinced that he had here to do with the beginning of the process of cell division.

"Thus these two points, that an amœboid germ gathers itself into a cluster before the furrowing, and that segmentation is preceded by peculiar movements, gave me the hint that the colourless corpuscles gathered into clusters and lying near the vessels were preparing for the act of division, and that the appearance and disappearance of the dark lines gave expression to this preparation.

"In fact I soon succeeded in seeing so deep a grooving of one cell that it appeared to be divided into two clusters. The shadow line became a clear and distinct mark while also smaller groovings took place on the lateral circumference. It had the appearance now of two separated clusters lying near each other. Closer observation convinced me, however, that the clear mark was only a non-granular zone of the cell—a zone which certainly showed a small indentation or groove. The mark became broader, it appeared as if it separated

> the granular clusters from each other, and then it became smaller again, and finally disappeared entirely; the clusters united once more, and there was no sign of the presence of a cell caught in the act of division, for it began again its amœboid movements and disappeared from the field.
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> "In another instance the mark remained, and also one of the apparently separated clusters tolerably unchanged, while the other began to move itself, gradually changed its location and dragged its motionless fellow after it; but the latter did not long remain passive, the whole mass flowed together again into one, and there was only an ordinary amœboid cell before me. Yet this condition did not remain long, the occurrences already described took place anew, shadow lines formed again, and after these had changed several times in intensity and direction, the clear mark appeared, which once more seemed to divide two large clusters in close proximity. But now the mark disappeared no more. For a time the clusters lay quiet, approached and moved from each other in a scarcely perceptible manner, until all at once one of them stretched out an arm, drew its body along after the projection, and the separation was completed. Soon the other cluster began to move, and the parted pair wandered in different directions over the field."

This process can be seen repeated with great frequency in the inflamed tongue of the frog and under favourable conditions. The time occupied by the process is, however, subject to great variation.

> "Sometimes I watched one field for half an hour and more without seeing a single division, sometimes I have caught one within a minute or two. It is a matter of course that only a limited number of form-elements can be simultaneously controlled. It is well known that only one can be fixed upon at once, but since the probability of success increases with the number under observation, I selected generally three or four corpuscles which I inspected by turns, and delayed that one whose furrow was most advanced, and in which the probability of an actual division appeared the greatest. So long as it was a question of attaining a decided conviction, the single chosen corpuscle was not allowed to pass out of sight. The reader will comprehend this precaution when I say that so long as only single elements are in the field, the division is a seldom occurrence, and that it goes on best where the pus-corpuscles are thickest; where, so to speak, the forest cannot be seen for trees.
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> "It may happen that the majority of the pus-corpuscles do not wander about, and that many of them, by the changing furrows, indicate their preparation for division, and that thus there is favourable opportunity for the attainment of our object. The field of vision, however, swarms with nomads, which increases the difficulty of observation. If the eye is not directed uninterruptedly upon a certain form element, while the halves shape themselves for separation, the identity of the nomads with the former cluster cannot be maintained.
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> "To the more practised observer the prolonged fixation, even under the unfavourable circumstances mentioned, will not be difficult, and I may indicate the division of the pus-corpuscle as a process which is now easily followed. As a precautionary measure the inflammation should be allowed to advance before beginning the study, until large knots of pus-cells are easily met with, points should be chosen where the circulation is in rapid play and the view limited to the parts surrounding vessels, or, better still, fixed upon collections of pus-cells in the vascular angles. Farther, the animal should be but moderately affected by woorara, so that it will become active again after six or eight hours, and the tongue should not be stretched more than necessary to pursue the examination. By stretching and by too large a dose of the poison the circulation is weakened, and thereby also the intensity of the process of division. Finally, I advise the use of lenses of considerable focal distance (objective 7 of Hartnack) for the investigation, pencilling of the wounded part of the tongue with a weak solution of chloride of sodium ($\frac{1}{2}$ per. cent.), and the immersion of the lens.
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> "In what precedes, I have shown in what manner, and under what conditions, division of the nomadic cells takes place. I have sometimes used this

term [Wanderzellen], and sometimes again spoken of pus corpuscles [Eiterkörperchen], and it is a matter of course that in both cases I refer to equivalent bodies. I have, besides, pursued my observations in the neighbourhood of vessels thus in localities where, doubtless, there were many colourless blood-corpuscles. I have also observed the attempts at division in form elements whose emigration I had before directly observed. Whether all moving cells found in the neighbourhood of vessels are emigrants, or descendants of such, I will not now discuss.

"I conclude, firstly, with the one fact, *that in inflamed parts nomadic cells or pus corpuscles increase by division.*"

After consideration of some objections which may possibly be advanced against his observations or conclusions, he proceeds to the real object in view when he began this study—to follow the changes of the connective corpuscles of the intermuscular tissues of the tongue. From his experience, which we have already given, his confidence of success had not been increased. The difficulty of maintaining the circulation in lively flow through the parts, the fact that the division of cells goes on but very slowly in the neighbourhood of blood-stasis, and may even be sought for in vain, and the fact that the inflammation itself does not proceed with the usual rapidity in poisoned animals, rendered all precautions in the highest degree necessary. A portion of the tissue was selected for examination, and its vascular arrangement carefully sketched under low power, then under a higher power. Several of the bodies lying in the interspaces were also drawn, so that the same objects could be again brought into the field, and the study continued, in spite of interruptions or postponements. These corpuscles of the connective tissue are of two kinds, the one in shape like an irregular cluster, the other more extended or stretched out and exceedingly irregular. If he did not succeed in seeing the division of these bodies, he satisfactorily established the fact that they possess the power of motion.

"I have kept such bodies in view many hours in succession. I saw groovings appear and vanish. While the mother cell lay motionless, an appendage attached to it by a mere thread executed lively motions, flowed again into the former, and new furrowings took place without, however, proceeding to an actual separation."

"A more extended course of observations soon taught me that, also, the extended and peculiarly shaped bodies possess a manifold degree of movability. In one case I followed the observation ten hours in succession. In the course of this time the animal became restless, and a second dose of woorara had to be administered. I expected, in this case, a division. The corpuscle which I had kept in sight from the beginning showed itself more active than usual. Not only was the play of furrow-lines lively, but single parts also changed their form independently. First it was only one terminal projection which showed activity, then the two next, and now the appearance was peculiar. Although one part of the body exhibited no striking changes, yet it appeared as if the body, originally like an extended S, had rolled itself up like a skein. It was afterwards observed that it was only the three end members whose change of form and position occasioned this deception."

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"It was decided that even the apparently stationary corpuscles of connective tissue in the course of the inflammatory process attain a certain degree of movability, that changes make their appearance which indicate attempts at division, and that, finally, parts of them become quite as movable as even amœboid cells."

"Embryology teaches that the immovable cells proceed from amœboid, and the inflammatory process shows us that the reverse may take place. I say *may* take place, because single observations do not justify us in drawing general conclusions, and because it borders upon probability that cells which have once reached a certain age are no longer capable of moving in totality.

"Whether movable connective tissue corpuscles actually divide, and in a wider sense increase, is, by the preceding observations, again made probable, but not really proved."

By all these trials the conviction had been forced upon the author that only insufficiency of means had prevented the actual observation of the process of division of the so-called fixed connective tissue corpuscles. He had recourse again to the cornea as a more promising field for pursuit of his object, and we will interpolate here, from the first paper of the series, a paragraph or two upon the structure of this membrane, and his mode of studying its cell changes.

"When the cornea of a healthy frog is brought under the microscope in its own aqueous humour, and with the other well-known precautions, at a little distance from the cut edges no structure can be perceived, the cornea appears, where evenly spread out, entirely homogeneous, and the upper and lower borders of the preparation can only be distinguished by the foreign matter adhering to them. At the turning point of folds, the anterior or posterior epithelium, according to the position, can be seen separated from the proper corneal tissue, but the layers of the former appear only as homogeneous zones.

"Engelman has expressed this fact, by saying that he considers the preparation the more successful the less he can at first see. For us, in view of the succeeding communications, it is a sign of the normal condition." For—

"The homogeneous appearance of the cornea is destroyed by any interference. If a foreign body is thrust into its centre, or if it be cauterized with nitrate of silver, certain form-elements can be recognized immediately after the excision. When only fifteen minutes have elapsed between the application of the injury and the excision, the anterior epithelium and many inter- and sub-epithelial nomadic cells are perceptible, and when one or two hours intervene, a smaller or larger number, according to circumstances, of the peculiar corneal cells, make their appearance, and remain, so long as no other changes occur, as dark islands upon a clear ground."

As a means of maintaining cell changes under observation, and of enlivening them when they begin to grow languid, the following plan, original, we believe, with Dr. Stricker, is pursued:—

"After the cornea is excised and properly prepared for observation, we decapitate the frog, collect its blood, and allow it to coagulate. We then, from time to time, touch one edge of the covering glass with a little of the coagula. Along the opposite edge we lay a strip of filter paper, which, when saturated, is replaced by another. Thus blood is supplied to one side of the preparation and withdrawn from the other. Under this influence a transudation goes on which can be made continuous or interrupted at the will of the experimenter."

In this manner his observation of cell changes in the cornea was pursued:—

"The first sure observation of cell-division I made in one of the large movable plates lying on Descemet's membrane. The structure was so fine that I could not at first distinguish it unless by shading off the side light from my retina. I then soon observed that it changed its form; I began to draw the figure of it, and even before the sketch was done it had ceased to resemble the original, and so the change continued for twenty minutes; then a diagonal mark formed and upon each side of the mark a flat elliptical nucleus became distinctly visible. Gradually the body upon each side of the mark corded itself in and went so far that the two halves only hung together by a slender thread. Each half now changed form independently, the nuclei became again invisible, one half grew pale while the other remained visible. But yet the uniting cord was not divided; it grew thicker again and for a time it appeared as if the trace of division had disappeared. Then the mark came again and again vanished, until finally, after perhaps an hour under continual transudation, the bridge of union was reduced to a small arm, the thread broke, its ends were drawn in and one of the corded-off but yet smooth halves left the field under active changes of form."

* * * "In this case the peculiar nuclei leave scarcely a doubt that we had to do with a large double nucleated epithelial cell. The division took place besides with such clearness that I am compelled from this observation to draw the conclusion that the epithelial cells of Descemet's membrane, under favourable conditions divide and change into nomadic cells."

Farther instances are then related of the observation of the same changes.

One question yet remains to be answered: "Can the direct transition of corneal cells into nomadic cells be observed in such a way?" This question he is not prepared to fully answer; he relates at length several observations going to show its possibility, and concludes the paper as follows:—

"From an extended range of attempts I have gained the conviction that a direct observation of the transition of a branched corpuscle into an amœboid is dependent upon accident or upon a very prolonged observation.

"It has now, to repeat once more, been also shown in the cornea that out of one nomadic cell two independent wandering elements may be formed. It has been further shown that a bi-nucleated cell, having no resemblance to a colourless blood-corpuscle, which from situation and form must be claimed as an epithelial cell of Descemet's membrane, can likewise divide into two nomadic cells; and finally it has been shown that larger many-nucleated and more inactive elements of the inflamed cornea can become, entirely or partially, as to appearance and movement, like unto the nomadic cells.

"After what has been demonstrated in the first paper as to the genesis of these larger elements, that becomes yet more probable, which was then left scarcely doubtful, that nomadic cells proceed from the branched so-called fixed corneal cells."

There are several other papers of the work deserving notice, the one on traumatic encephalitis especially, yet the fact that only by little less than a complete translation could justice be done to them, forbids us entering upon their examination. We turn, therefore, to the conclusion, which is not so complete a *résumé* of the subject as we had hoped to find, undoubtedly because of the fragmentary character of the work, made up as it is of studies of special points, and we must wait therefore for that complete account of the process of inflammation which we are satisfied no one is better able to give than the editor.

First as to the exit of the colourless corpuscles from the bloodvessels, we learn that

"It is a proved fact that, in the beginning of the inflammatory process, troops of these corpuscles leave the vessels and spread themselves abroad in the tissues. The question then, whether pus corpuscles originate from the blood, needs no more to be propounded. It must, however, be asked, From what *other* sources does pus originate? To this there have been various answers returned in the foregoing papers.

"It has above all been shown that the pus corpuscles themselves divide, and it has been shown to be probable that in profuse suppurations the most important mode and origin of the pus is to be found in the process of division. It has further been shown that the epithelia, partly by division and partly by endogenous growth, gives birth to a young generation. It has been shown that the corpuscles of the connective tissue, during the course of the inflammatory process, take on properties, after which the ability to divide can no longer be denied to them—even that, in consequence of these properties, they already possess the character of pus corpuscles. It has, finally, been shown that the muscle corpuscles increase in number.

"We can thus lay down the following general proposition: *The pus corpuscles originate from various sources.*

"It has further been shown that, as a consequence of the inflammatory process, there may be an outgrowth of the capillary vessels, a transformation of the liver cells into fibres, and, finally, that under certain circumstances the nuclei of nerve-cells increase in number. All these processes indicate disturbances of nutrition, which must be explained as increased vital processes. For increase of substance, change of form, the appearance of new nuclei, are vital processes, and when they are formed where they were not present before, an aliquot part of the vital process must have been increased.

"We may also present the following proposition, which is of general application, because the occurrences have been observed in all types of cells: *The inflammatory process is accompanied by an increase of function of the cellular elements influenced by it.*"

While then we are driven towards Virchow's views as to the essential importance of the local disturbance of nutrition, it will not do to consider the term inflammation as defined by a statement of this part of the process. Neither will it do to consider it as merely an exit of colourless blood corpuscles from the vessels. A majority of the rising generation, we are told, do thus look upon it, and, to use an expressive German proverbial phrase, "throw the child out with the bath." A statement of both these processes will not cover the term inflammation.

> "If we would hold fast to an independent clinical idea of acute inflammation, we must define it otherwise. Or rather we cannot define it, we must describe it according to the manner of Celsus. We must enumerate its characteristics in order to represent the clinical process, and among these a prominent position must be accorded to the 'disturbances of nutrition.'
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> "A not less important role must be accorded to the 'exudation.' . . . . The importance of the exudation stands again to-day, in the minds of physicians and experimenters, as high as at the time when it was so strenuously maintained by Bennet and Rokitansky. . . . It is an important, perhaps, with the nutritive disturbance the most important, characteristic of inflammation."

The following processes take place in inflammation experimentally produced, with the order of their occurrence :—

> "Traumatic influence, disturbance of circulation, exudation of fluid and morphological constituents, disturbances of nutrition—new formation.
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> "Neither of these characteristics is alone decisive. An injury may be effected, disturbance of circulation may become perceptible to our eyes, without inflammation following, and without our being able, with our present means, to say that this disturbance of the circulation is really different from the inflammatory.
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> "That the exudation alone does not make inflammation is proved by œdema, and again we find ourselves without the means of recognizing the finer features which characterize the inflammatory exudation."

Small as this work may be in comparison with the importance and extent of the subject studied, and minute as the points settled may be, it belongs to a most valuable class of scientific publications, and by such workers as its authors is the hidden to be made plain and the unknown to become known. It is indicated as the first of a series, and we shall look with interest for those which are to follow. J. C. R.